


**Acceptance Plan for Operation of the TTB Line With Low Mass Ions  
and RHIC With Deuterons**

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*TABLE OF CONTENTS*

<b>I. INTRODUCTION .....</b>	<b>3</b>
<b>II. SCOPE .....</b>	<b>3</b>
<b>III. RELEVANT DOCUMENTS AVAILABLE ON-LINE .....</b>	<b>4</b>
<b>IV. CONDUCT OF OPERATIONS .....</b>	<b>4</b>
<b>V. TRAINING .....</b>	<b>4</b>
<b>VI. OPERATIONS SCHEDULE .....</b>	<b>4</b>
<b>VII. LIST OF NEW/UPDATED PROCEDURES AND/OR TASKS REQUIRED FOR OPERATIONAL READINESS (PERSON RESPONSIBLE) .....</b>	<b>5</b>
<b>VIII. RESPONSIBILITY MATRIX .....</b>	<b>7</b>

## **I. Introduction**

This acceptance plan describes necessary activities to be completed by the Collider Accelerator (C-A) Department prior to the ARR and commencement of routine operations of the TTB Line and RHIC with deuterons. It is intended that this acceptance plan help the C-A Department prepare for an appropriate readiness review as required in DOE Order O 420.2, Section 5 b. An appropriate Accelerator Readiness Review (ARR) must be conducted following the declaration of readiness for routine operations. The ARR report must support the decision by the DOE Field Office to approve the commencement of routine operations.

This plan is intended to ensure the C-A Department avoids unsafe or environmentally unsound operations. It is noted that routine operation of the TTB and RHIC with deuterons may be concurrent with other operations; e.g., the fixed-target program in Building 912. From an operations standpoint, deuteron operations is viewed as a portion of a spectrum of operations in which machine physicists and shift-based operations personnel work out of a single Main Control Room (MCR) in Building 911. The role of the physicists and operators located throughout the complex is to achieve efficient, safe, and environmentally benign conveyance of deuterons in the machines and transfer lines during all operations.

C-A Department staff and Users are subject to the requirements of the Collider-Accelerator Conduct of Operations Agreement. The Conduct of Operations Agreement requires the on-duty Operations Coordinators be responsible for operation of the Collider-accelerator complex. The operations staff consists of Operations Coordinators and Operators, as well as personnel from operations-support groups under their purview. Operations staff is trained, and only qualified personnel execute operation of the Collider-Accelerator complex. All authorizations, all permanent or temporary procedures, all Accelerator Safety Envelopes or Operational Safety Limits, and all responses to emergencies or occurrences must follow the formal processes identified in the Conduct of Operations Agreement. The BNL Directorate and the C-A Department management hold this understanding of the Conduct of Operations Agreement for the purposes of safe and environmentally sound operations.

## **II. Scope**

The scope of this plan covers acceptance for routine deuteron operations in the TTB and RHIC. The plan is intended to help prepare for the following specific issues that will be verified by the ARR:

- Procedures, administrative controls, personnel training and qualification relevant to routine operations with deuterons are in place
- Engineered safety system for radiation protection in the TVDG and in the TTB tunnel are approved by the RSC and tested
- Shielding changes for TTB are completed

- Use of deuterons in RHIC is within the parameters given in the existing RHIC ASE

It is noted that the upgraded engineered safety system for radiation protection at TTB/TVDG is similar in design to those used for the RHIC. The system includes beam crash, access control, radiation monitors and critical devices. Additionally, it is noted that the earth berm at TTB has been raised to meet a minimum thickness of three feet.

### **III. Relevant Documents Available On-line**

- [TVDG Safety Assessment Document](#)
- [TTB Safety Analysis Report](#)
- [Proposed TVDG/TTB Accelerator Safety Envelope](#)
- [Collider-Accelerator Department Conduct of Operations](#)
- [Collider-Accelerator Department Operations Procedures](#)
- [Unreviewed Safety Issue 3 for TTB](#)
- [Training and Qualification Plan](#)
- [Quality Assurance Procedures](#)
- [Configuration Management Plan for C-A Access Control System](#)
- [Procedure for Review of Shielding Design](#)
- [Procedure for Unreviewed Safety Issues](#)

### **IV. Conduct of Operations**

All staff will be working under the procedures and authorizations prescribed by the existing [Collider-Accelerator Conduct of Operations](#).

### **V. Training**

The existing system for training, which can be audited, is maintained by the Collider-Accelerator Department Training Group. Records are maintained in [BTMS](#).

BTMS job title relevant to routine operations and the minimum numbers of qualified personnel required for routine operation are:

- MCR Operations Coordinator, AD-510 (1 per shift)
- MCR Operator, AD-560 (1 per shift)
- Tandem Van de Graaff Operator, AD-012/AD-014 (1 per shift)
- C-A Radiological Control Technician, RP-01 and AD-520 (1 per shift)
- Collider-Accelerator Support, AD-570 (1 per shift)

### **VI. Operations Schedule**

Operating Items for TTB and RHIC Using Deuterons, Persons Responsible, and  
Scheduled Readiness Date

SCHEDULE: Operate TTB and RHIC with deuterons on or about November 1, 2002.
DESCRIPTION: New TTB/TVDG engineered safety equipment will be operated with deuteron beam in the TTB line. The shielding above the TTB line will have been raised to a minimum three-foot thickness. The RHIC will operate with deuterons.
<p>OPERATING REQUIREMENTS (Persons Responsible)</p> <ul style="list-style-type: none"> <li>• All related RSC items are closed out (D. Beavis)</li> <li>• Critical devices, beam current monitors and reach-backs for radiation protection have been established (D. Beavis)</li> <li>• The access control system is operational and tested (A. Etkin, N. Williams)</li> <li>• New sweep procedures are complete (C. Carlson, P. Ingrassia)</li> <li>• New TVDG operations procedures are complete (C. Carlson, J. Alessi)</li> <li>• Fault Study Plan prepared (J. Alessi)</li> <li>• RSC Check-Off List prepared (J. Alessi)</li> <li>• Accelerator Safety Envelope for TVDG/TTB is complete (E. Lessard)</li> <li>• Training records for operations staff are complete (J. Maraviglia)</li> <li>• Assure deuteron operations in RHIC are within RHIC ASE (A. Stevens, D. Beavis)</li> </ul>

**VII. List of New/Updated Procedures and/or Tasks Required for Operational Readiness (Person Responsible)**

(E. Lessard)

OPM 2.5.1, Operational Safety Limits for Tandem Van De Graaff

OPM 2.5.2, RHIC Accelerator Safety Envelope Parameters (Revised)

(P. Ingrassia)

OPM 4.56. Number to be determined, TVDG Sweep Checklist

OPM 4.56. Number to be determined, TTB Sweep Checklist

(N. Williams and A. Etkin)

OPM 4. Number to be determined, TVDG/TTB Security Gate Subsystem Check

OPM 4. Number to be determined, TVDG/TTB Crash Subsystem Test

OPM 4. Number to be determined, TVDG/TTB Critical Response Subsystem Checklist

OPM 4. Number to be determined, Confirmation of Proper System Operation of PASS for TVDG/TTB

(N. Williams and J. Alessi)

- Add harp and dual Chipmunk to limit beam current at TVDG

- Locate harp (or equivalent) to create  $\sim 15$  mrem/h at 100 nA
- Set Chipmunk interlocks at  $\sim 25$  mrem/h
- Limit field in bypass dipoles for beam from MP6 to TTB
  - Use equivalent method to limit beam energy from MP7 to TTB if MP7 is used
- Add dual set of door interlocks in the TVDG accelerator room
  - Mechanical equipment room
  - TVDG control room
  - Target Room 4
  - TTB gate
  - Downstairs electrical equipment room
  - Downstairs mechanical equipment room

(J. Alessi)

- Ensure TVDG operators are trained in new procedures
- Create operation procedures in OPM Chapter 12 to
  - Limit hourly average deuteron currents to 200 nA
  - Limit terminal voltage to 6 MV
  - Limit dc average current to 200 nA or less
  - Restrict deuteron source to be MP6 only
  - Respond to Chipmunk alarms and interlocks
  - Disable 2<sup>nd</sup> set of door interlocks in TVDG
  - Minimize use of Faraday cups in TTB

(D. Beavis and J. Alessi)

- Issues to be checked at TVDG by RSC
  - Redundant interlock string switched in for deuteron operations
  - Bypass-line dipole fields are limited
  - Beam intensity monitor is locked in the inserted position
  - Chipmunk interlocks are switched in
  - The target-room-opening shields for scattered beam are in
  - The shielding at beam opening to Target Room 1 is installed
  - Entry into a TVDG tank requires a check for contamination by RCT
  - A fault study at the NW corner of Tandem Control Room is performed and evaluated
  - A fault study near Rutherford Drive and TTB is performed and evaluated
  - The earth shield along TTB is 3 foot thick or more
  - Two beam stops have been added at low energy end of MP6
  - Two beam stops have been added at low energy end of MP7
  - Logic and testing of changes to ACS at TVDG/TTB have been reviewed and approved
  - New ACS wiring, logic and testing is documented
  - All changes to existing ACS are configuration controlled
  - The redundant ACS in TVDG is a QA1 system

## VIII. Responsibility Matrix

Acceptance Plan Element	Training - Records, Coordination	Fault Study Plan	Fault Study Review	Sweep Procedures	Operations Procedures	Access Control System Review	RSC Checklists	USI and ASE for TVDG/TTB	Assure Deuterons Within RHIC ASE
Person(s) Responsible									
A. Etkin						X			
H. Kahnhauser			X						
D. Beavis		X				X	X		X
J. Alessi		X			X		X		
C. Carlson				X	X				
E. Lessard								X	
J. Maraviglia	X								
N. Williams						X			
P. Ingrassia				X					
A. Stevens									X